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ABSTRACT

The Oswego City School District is committed to creating--through the implementation of its technology plan--an environment that supports effective teaching and learning and prepares all students to succeed in a technologically sophisticated world. This report summarizes the efforts to build a community-wide consensus for a meaningful technology plan. Objectives set and accomplishments made during the first year and the remaining years of the five-year technology plan are identified. Also discussed in the report are: the evolution of the plan; the nature of the Fiber Distributed Data Interface (FDDI) infrastructure that will support the educational program; classroom, computer lab, and building-wide computer resources; and library automation. In addition, long-term considerations, including the development of a long-term plan for network and systems support, video applications, and staff development are described. A glossary of terms is provided. Contains an article, "Teaching Tommorrow Today: Oswego City Schools Lead the Information Age..." by Dr. Kenneth W. Eastwood and two charts detailing the Oswego City School District Data/Video Network Design and the Network Design. (AEF)

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# Using Electronic Technologies to Support Teaching and Learning

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## Preface

Archimedes is said to have claimed, "*Give me somewhere to stand, and I will move the earth.*" Experiments with geometry had convinced him that a simple tool, the lever, could do what seemed impossible. Likewise, as a result of careful planning and the implementation of technological improvements within the Oswego City School District, students, teachers, and community members will use a different kind of lever, networked electronic media, to "*move the world*", figuratively.

**A technology plan is never finished. It must be continually revised and updated to avoid obsolescence.**

– Dr. Frank Betts, Association for Supervision and Curriculum Development, Report #2

## Building a Community-Driven Technology Plan

As with any quality-improvement initiative, the journey is its own reward. In Oswego, New York, building a five-year plan for the use of technology to support teaching and learning has brought the community together to discuss the future of education. Parents, business people, community leaders, school board members, and educators collaborated to define needs and to find ways of giving the district's young people a competitive advantage in a challenging social and economic environment. Working together, community members laid the foundation for a student-centered vision for the use of electronic technologies.

This vision calls for the achievement of four key objectives:

- Construct an electronic information network.
- Provide equity of opportunity for all students to learn using technology and access to network resources.
- Develop the ability of students and teachers to use networked resources efficiently.
- Eliminate barriers to using technology that are associated with system maintenance and obsolescence.

## Objectives – Year One

After developing and approving its Vision for the Use of Technology in Support of Teaching and Learning, the Board of Education charged the district's Director of Secondary Education & Instructional/Administrative Technology with three objectives:

- **Establish an infrastructure**
  The vision statement's first objective–to establish an electronic network or information pathway–is fundamental to achievement of the district's other objectives. Establishing this objective is no small task: the school district comprises eight separate campuses, a district office, a transportation center, and a warehouse. In addition to linking these physical district resources, the infrastructure is intended to link the Oswego City Schools to a virtual "global school" on the Internet.
- **Improve the technological capacity of the school district and public library systems**
  An independent assessment of the district's current use of computer technology found that most of the district's libraries were inadequately equipped for the task of preparing students to succeed in the information age; indeed, equipment age was as much as ten years and provided little or no access to resources.
- **Conduct an instructional needs assessment**
  The needs assessment's purpose was to clarify teachers' greatest instructional challenges. The data collected will guide the district's adoption of technologies that best support teachers' efforts to meet those challenges. Data was collected at elementary, middle, and high schools, as well as at the district's alternative secondary school, The Academy.

As electronic networks help Oswego's schools to share information resources (including text, sound, graphics, and video images), the community will receive greater value from its educational resources. As students gain the skills needed to work with new technologies, they will become better able to succeed in the workplace.

## Accomplishments – 1994-96

The first two year's accomplishments are most significant. Three achievements, in particular, establish the foundation upon which the district will build its capability to use technology to support teaching and learning:

- Develop classroom-based data before buying educational technology.
- Design and begin to install a network that offers solutions for today as well as tomorrow.
- Make libraries the heart of the school district's instructional resource.

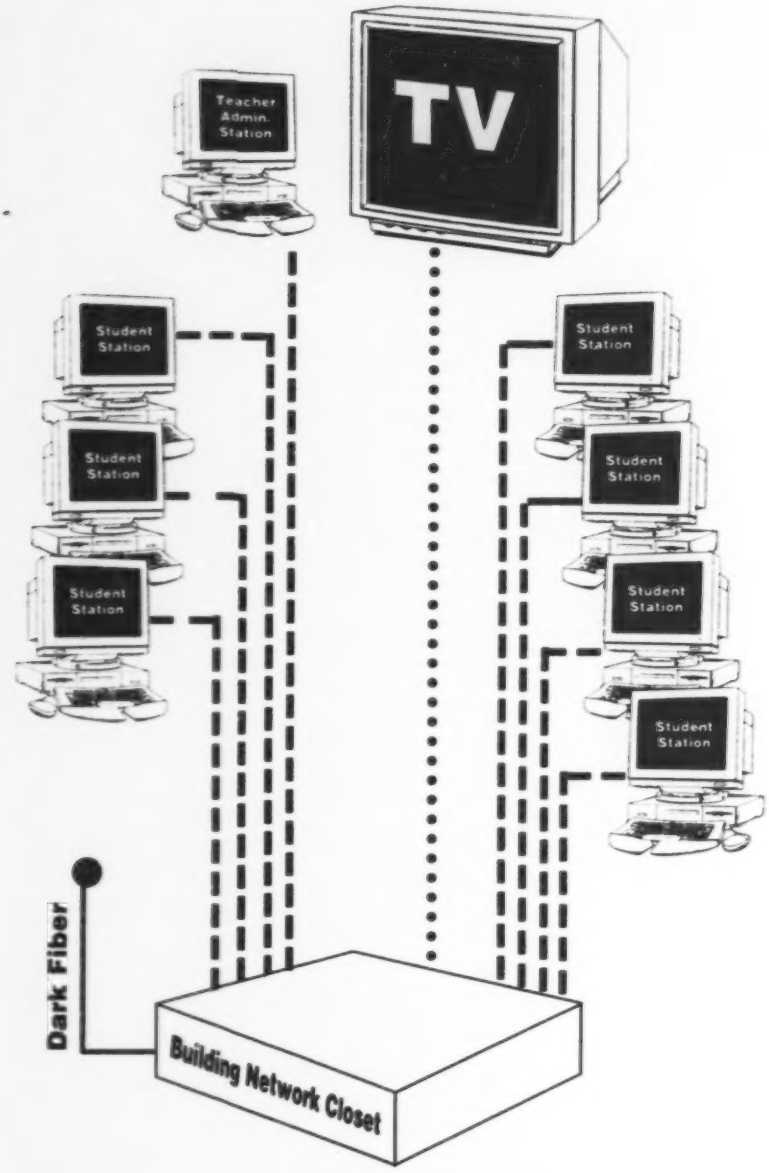
Though they may seem to reflect little more than good common sense, accomplishing the first two of these tasks required breaking paradigms. First, research shows that districts often fail to involve teachers in their technology planning efforts. Second, in the past, instructional technologies used in the classroom often reflected vendor's offerings more accurately than classroom needs. We have developed a plan that is both classroom and learner driven rather than market driven.

## Fulfilling The Plan – The Future

In the remaining years of the five-year plan, the district will focus on matching technological solutions to the instructional needs identified in the district's needs assessment. Outcomes of this "matchmaking" process will include purchasing of hardware and software, teacher training (to facilitate the implementation of new technological strategies), and developing service strategies. The future holds the promise of improving community access to the school system's resources and linking schools with the public library system.

The Oswego City School District has embraced an ambitious set of objectives designed to ensure that graduates possess the world-class information-management skills they'll need in the workplace and in higher education. Through citizen and teacher involvement in its decision-making process, the district is building a future for the children and community it serves.

# Oswego City School District
# Classroom Network Design




1 – CATV Coax linked to District Media Management System and Teacher/Admin. Workstation

8 – separate 10/100 Mbps CAT-5 Copper connections linked to 100 Mbps FDDI Ring

2 – strands of multimode fiber optic cable (unterminated at this time) designated for future applications

**Note:** Class configurations will begin with 3-4 student multimedia workstations and one teacher multimedia/administrative workstation. The classroom has the potential for 8 separate workstations via CAT-5 copper.

## Introduction

Preparing students for a successful future is the fundamental role of every elementary and secondary education system. As the amount of scientific knowledge and other associated information continues to grow, students must learn how to access and select from an avalanche of information to help them solve real problems. In such a world, competence in information processing and in the use of electronic technologies will define the success of many of the district's graduates.

The Oswego City School District is committed to creating–through the implementation of its technology plan–an environment that supports effective teaching and learning and prepares all students to succeed in a technologically sophisticated world.

The district will incorporate technology as a natural part of education through an integrated, comprehensive framework that governs the acquisition, application, and evaluation of technological resources. This framework helps to ensure that all students are provided opportunities to develop the lifelong learning skills necessary to be productive citizens in an information-driven, global society.

The district plan provides appropriate technology that helps students to . . .

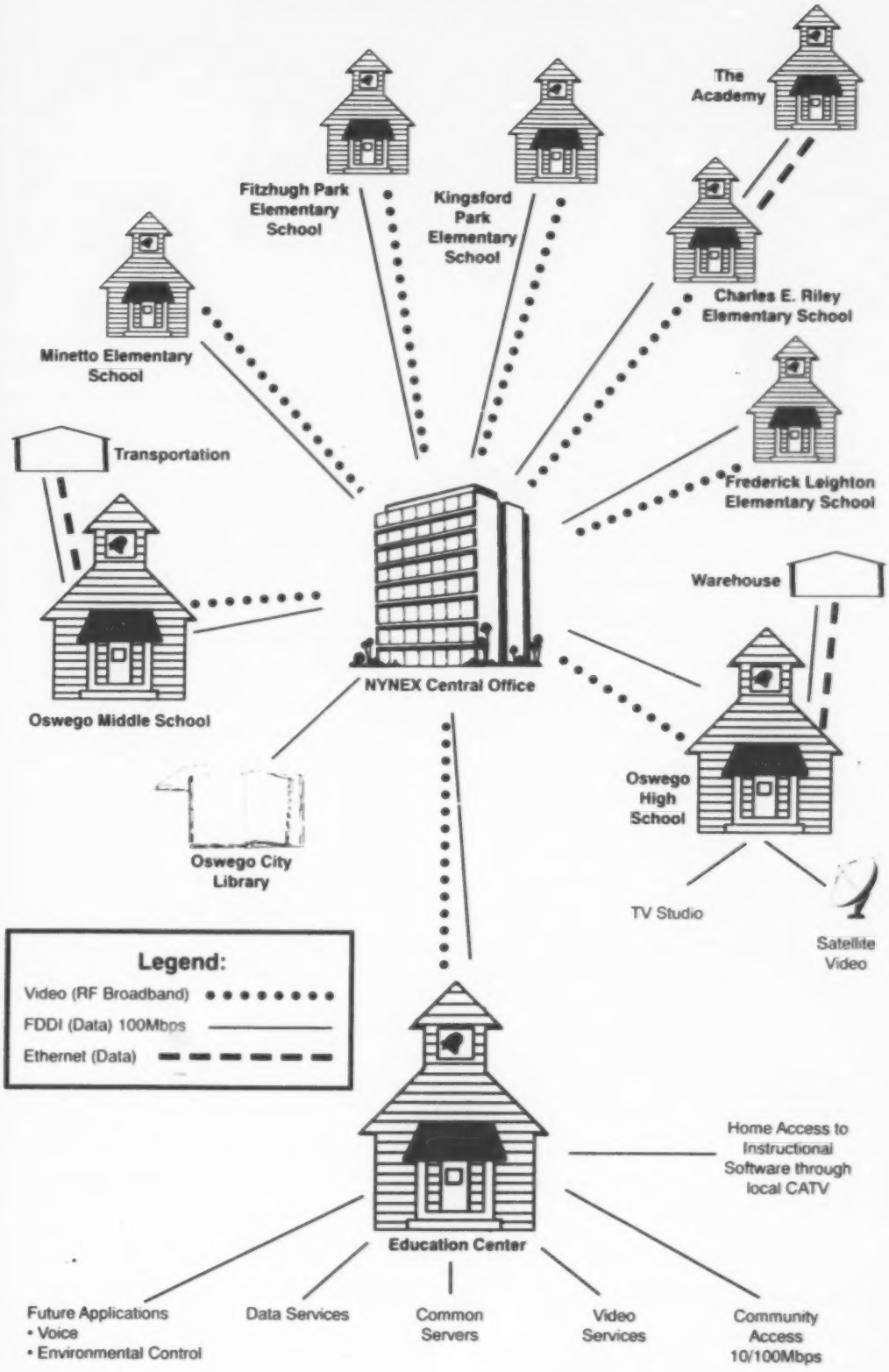
1. Strengthen information-processing competencies.
2. Improve critical thinking, problem-solving, and decision-making skills
3. Access, analyze, evaluate, and communicate information in expedient, efficient, and creative formats.
4. Work ethically, independently, and collaboratively with a diverse and changing population within the classroom and school as well as across state, national, and international boundaries.

The district plan provides technological solutions that support staff members' efforts to meet curricular challenges and to . . .

1. Improve instructional strategies to increase student achievement and narrow the gap between high and low achievers regardless of ethnic or socioeconomic status, learning styles, or abilities.
2. Assess, monitor, and communicate student progress.
3. Improve professional skills.
4. Collaborate through sharing of skills and resources, within and beyond the local school system.
5. Demonstrate leadership and vision for the use of technology to increase student achievement and staff productivity.

This report summarizes efforts to build a community-wide consensus for a meaningful technology plan. In addition, this report describes the nature of the infrastructure that will support the educational program, identifies accomplishments made during the first year, and presents goals and objectives for the remaining years of the five-year technology plan.

# Oswego City School District
# Data/Video Network Design



## Creating the Technology Plan

**Evolution of the plan**

In 1993, under the leadership of the district's Director of Secondary Education and Instructional/Administrative Technology, the district began the task of developing a district-wide technology plan.

In February 1994, the Association for Supervision and Curriculum Development's (ASCD's) Education & Technology Resources Center (ETRC) reviewed the district's draft Long-Range Plan for Technology in Support of Teaching and Learning, 1994-1999.

In March 1994, ETRC's Dr. Frank M. Betts visited Oswego in order to help the district to develop and articulate a student-centered vision for integrating the use of technology in teaching and learning. His findings emphasized what so many already realized: the district was, in Dr. Betts' words, "falling into the bottom half of schools in the use of technology to support instruction." Indeed, ETRC reported that "at least 80% of the computer technology in the Oswego schools is obsolete; that is, it is inadequate for use with the current generation of instructional applications now in use in many schools."[1]

In addition to the problems created by obsolete equipment, the distribution of computers was identified as problematic. According to the ETRC report, "research suggests that 4 - 6 computers plus the accompanying peripherals . . . are most effectively used in direct support of instruction." Dr. Betts found, however, that . . . most computers in the City of Oswego School District are concentrated in labs or in clusters of one or two computers. Computers in labs are rarely accessible for instruction at times other than previously scheduled and do not allow flexibility in the use of time . . . They are frequently seen as someone else's responsibility rather than as an instructional resource, and are suitable chiefly for whole group instruction . . .[2]

During the site visits, Dr. Betts met in focus groups with over 100 members of the district's faculty, staff, administration, school board, as well as with significant numbers of parents and members of the local business community. The focus group meetings provided information needed to develop and articulate a student-centered vision for the use of technology.

In April 1994, faculty and staff members received copies of the district's draft vision statement for review and comment. In addition, the district held a public forum to solicit community input. Based on input from the focus groups and community, Dr Betts released a third report proposing options for implementing the vision, including organization, staffing, cost and financing.

In May 1994, the Board of Education adopted a formal vision statement that outlines the district's intentions. (This vision statement is condensed on the following page.)

[1] Report 3: Implementing the Vision for Technology, (April 28, 1994), p. 12.

[2] Report 2: A Vision for Technology in the Oswego City School District– Long Range Plan for Technology Support of Education, 1994-1999, (April 5, 1994), p. 3.

## Vision for the Use of Technology in Support of Teaching and Learning

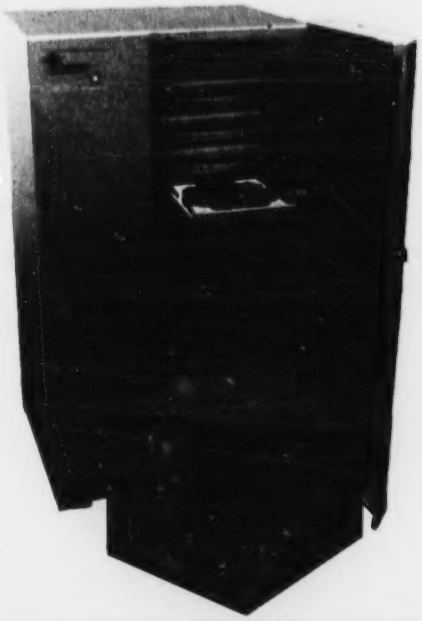
The Oswego City School District is committed to creating an environment which supports effective teaching and learning and maximizes the opportunity for each student to learn and the capacity of each instructor to teach. In order to "work smarter" and make the most effective use of our human resources, we must extend our capabilities through the use of technology in support of teaching and learning:

- To permit students to be taught what each is capable of learning in cost-effective ways and at a rate which increases his or her opportunity to be successful;
- To fulfill our responsibilities established by the mandates of the New York State Department of Education curriculum frameworks, which require students to demonstrate the ability to use a variety of technologies, including computers and telecommunications, to solve significant problems and communicate with a wide variety of audiences locally, nationally, and internationally; and
- To prepare our students to compete successfully for admission to institutions of higher education, to secure employment and succeed on the job, and to demonstrate the skills, attitudes, and habits of mind which allow them to become lifelong learners.

In order to realize our vision, we must plan aggressively to implement four elements:

- An electronic network or information pathway which increases access to and facilitates the exchange of information and resources in support of teaching and learning by linking schools and institutions in the community.
- Equity of opportunity to learn using technology and access to the network resources, which to the greatest extent possible should be independent of the time of day or the location of the learner.
- The ability of students and teachers to use the networked resources effectively to support teaching and learning.
- To the maximum extent possible, eliminating the barriers to the effective use of technology associated with inadequate maintenance and obsolescence.

In adopting this vision, we recognize that there are many options available for implementation. Therefore, the school district administration should prepare and submit a report and technology plan to the Board annually prior to budget approval showing the current status of the use of technology in support of teaching and learning, accomplishments and planned actions to realize this vision, and periodic reports at other times as appropriate to keep the board members fully informed of progress.



## Establishing the Infrastructure

**The purpose of and goals for the network**

The district's technology plan sets forth specific recommendations for the development of a comprehensive educational network of computers and information technologies and resources. This network is comprehensive both in the variety of educational technologies to be provided and in its wide and equitable access to students.

The plan ensures that all students from kindergarten through high school, regardless of the school building, have equal access to educational technologies and resources. The proposed plan includes recommendations to ensure that students will be able to experience and receive instructions from a wide variety of educational technologies:

- Curriculum-specific software that meets identified instructional needs
- Desktop computers
- Networking and telecommunications
- Automated library and media center
- Electronic communications and messaging
- Video applications and distance learning
- Interactive multimedia technologies
- Access to local and worldwide educational resources and databases
- Other appropriate forms of technology as they emerge

All appropriate spaces (such as classrooms, libraries, resource rooms, suppoat facilities, administrative offices, and teacher facilities) in all school buildings will be retrofitted with the necessary infrastructure improvements.

Establishing a design that will enable the district to expand the implementation of its plan in future years is critical to the overall success of the technology planning process. These goals are based on principles of network control and analysis and may be achieved only through planning and use of adequate management tools.

Based on the following five goals, Educational Learning Corporation developed recommendations for the technology infrastructure:

- **Stability**–Create the network infrastructure once. Both technological and topological changes must be achieved without disruption.
- **Flexibility**–Provide for expandability and saclability by selecting standards for applications, platform protocols and carrier services.
- **Manageability**–Adhere to industry standards and maintain a commitment to technology management and network analysis.
- **Performance**–Capacity planning and adequate bandwidth for advanced communications and applications.
- **Cost-Effectiveness**–Investment protection and longevity. Appropriate use of existing and new equipment and an overall design for voice, data, and video on the same infrastructure.

## The Fiber Distributed Data Interface (FDDI) Backbone

**Network Design Solution**

The district and its partner, The Educational Learning Corporation (ELC), investigated a number of possible network protocols including T1, ISDN, ATM, and Dial Up, before deciding to adopt the Fiber Distributed Data Interface (FDDI) protocol. The FDDI solution will connect all buildings and their associated local area networks via a district-wide fiber-optic and building-wide copper "backbone." This FDDI backbone offers the most stable, high-speed networking technology available. In addition, FDDI is the most cost-effective technology, offering the greatest bandwidth capability for the district's investment and will meet the district's anticipated needs for the foreseeable future. This FDDI solution, although new in educational environments, is common technology in the private sector.

The design includes LAN interconnect services for Ethernet and 100 Mbps FDDI with the capability for expansion to still higher speed ATM technology. All buildings will be LAN interconnected via NYNEX LAN interconnect services through the local NYNEX office. The building-level LANs together with the district-level WAN form the networking and interconnectivity infrastructure upon which other resources, capabilities, and services are to be provided. The district networking infrastructure will connect to the global Internet for access to "the global school" and offers students access to deeper, richer educational experiences including electronic access to virtual textbooks, libraries, and museums. Moreover, it is hoped that through this technology, students will develop a growing sense of global citizenship and a desire to participate in lifelong learning experiences. The network will be accessible from each network connection as well as from outside sources.

In addition to these educational advantages, the FDDI infrastructure offers–through the segmentation of instructional and administrative networks–the highest levels of efficiency and security. The design enables teachers and administrators to access the educational and media center networks efficiently while protecting the security of administrative data.

**Connectivity**

The networking infrastructure will provide the following interconnectivity:

1. Among all computing resources (for example, desktop computers, file-servers, printers, CD-ROM drives, etc.) both within and among all district school buildings.
2. Accessing and sharing software packages and educationally appropriate end-user application tools (for example, library automation services, word-processing, specific subject area tools, etc.) by all teachers and all students.
3. Providing electronic communications among users for easy access to all educational information sources located within the district (for example, library catalogs, periodicals database, and CD-ROM towers) and all over the world via the global Internet.
4. Integrating RF broadband video applications (including media retrieval and a bidirectional conferencing capabilities) in the classroom from a single source.

The planned computing and networking environment will be designed to support a variety of computer hardware and operating system platforms from different manufacturers including Digital Equipment, IBM, Apple, and Microsoft, etc.[3]

[3] Digital Equipment, IBM, Apple, and Microsoft are registered trademarks.

The design proposes state-of-the-art techniques for connecting remote users and resources to a centralized application distribution environment. While the network design is unique to education, it is modeled after networks used successfully in the private sector and provides over 65 percent greater bandwidth, improved security, and lower operational costs than traditional WAN designs.

Critical to the ongoing success of the plan is the design of the networks–both LAN and WAN–to enable user access to the application environment. Standards for each networking subset are as follows:

- **Network Media**–UTP Category 5, Multimode Fiber, Single-mode fiber, Coax RG6 (Video)
- **Network Media Access**–10baseT, 10baseF, 100baseTX, FDDI
- **Network Topology**–Tiered Star
- **Network Protocols**–TCP/IP, IPX
- **Network WAN**–Synchronous, Asynchronous
- **Network Management**–SNMP-manageable devices

**File and Application Servers**

The chosen network design makes it possible for instructional and administrative servers to be located at a central facility. This reduces the need for increasing support staff, reduces telecommunications and software licensing costs, and improves network performance. Servers host single or multiple applications and can be segmented by user group. The IBM AS/400 and several Windows NT servers are attached to the central FDDI ring.

The choices for the Server/Host platforms are also based on the selection of applications as well as the necessity to integrate any legacy applications. In some cases, the applications and hosts may be under the control of organizations other than the school district (for example, BOCES). Additionally, limitations of functionality, media access, and bandwidth may occur when trying to access "outside" servers. In these instances, careful planning and coordination assure user accessibility.

The following server standards were developed during initial planning sessions:

**Server Operating Systems**

- Microsoft Windows NT Advanced Server 3.51
- Microsoft Windows for Workgroups 3.11
- Macintosh OS
- AS/400 OS

**Server Platforms**

- Intel 486 (Upgradable Processors)
- Intel Pentium
- Power Macintosh
- IBM AS/400

## Computer Resources

As the funding plan is implemented, the district will place computers in individual classrooms, and offices. During the initial planning phase for this effort, the district, selected the following standards for the client platforms:

**Client Operating Systems**

- MS-DOS 6.22
- Windows 3.1
- Windows for Workgroups 3.11
- Macintosh OS

**Client Platforms**

- Intel 486 (Upgradable Processors)
- Intel Pentium
- Power Macintosh
- Macintosh

As needs and operating systems evolve, consideration will be given to Windows NT Workstation, Windows 95, and Unix. The selection of Windows NT allowed the district to enjoy a significant cost savings of over $80,000 in licensing fees vs. the use of other network operating systems.

The applications will determine the actual system configuration (including form factor, monitor type, memory, hard drive capacity, CD-ROM, network interface card [NIC], and client operating system). Many existing workstations are likely to require some type of upgrade to function properly in the enhanced district network. Once solutions to instructional challenges are identified, the district will identify appropriate hardware for acquisition. While some upgrades will require memory expansion only, all PCs and Macs will need to support the set of protocol stacks, versions of the operating system, and drivers required for interconnectivity to the new applications and LANs. Staff input and evolving instructional models will determine the actual distribution of computers. General guidelines related to the number and locations of computers follow:

**1. Classroom Resources**

The typical classroom (all grade levels) will be equipped with one teacher workstation and three or more student workstations as well as printing and classroom-wide viewing capabilities.

**2. Computer Lab Resources**

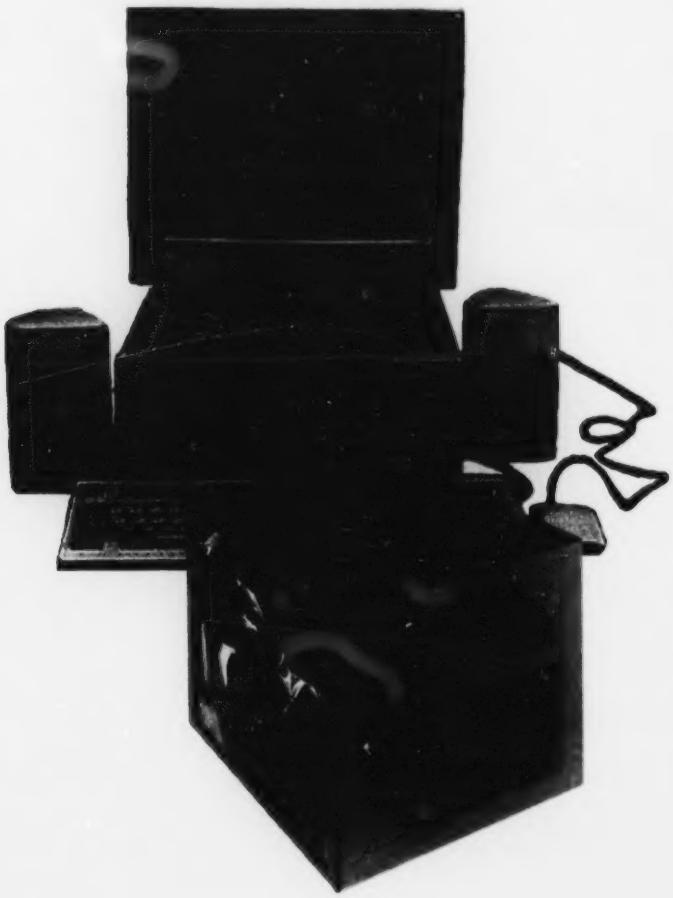
Oswego Middle School will house three computer labs dedicated to strengthening students' skills related to specific instructional programs in technology. One lab, used for teaching introductory word-processing and spreadsheet skills, will be equipped with a mixed platform of Windows-based and Mac computers. The second lab, used for training in desktop publishing and graphic arts, will be equipped with Power Macs and peripherals. The third lab, for instruction in computer-assisted design, will be equipped with Windows-based computers. All three labs will be connected to the district's WAN.

Oswego High School will house a variety of lab resources. A primary computer lab will provide students with tools for independent work and research. This lab will offer 20 computers: 10 Windows-based and 10 Power Mac workstations. Other curriculum-specific computer labs will address CAD-CAM instruction, college-level computer engineering courses, and graphic arts/journalism courses, business courses and writing courses.

In addition to these labs, the high school will house a multimedia instruction center with 12 Power Macs and 12 Digital computers, each equipped with a CD-ROM drive and connected to a multimedia application server. A sperate production station will enable students and teachers to employ a rich variety of resources to create instructional multimedia products. Each computer will have full access to the district network. This multimedia instruction center will also house all staff development, and is capable of delivering teleconferencing and distance learning programs. The classroom also acts as a "smart" electronic rich environment for students during the regular school day.

**3. Building-wide Resources**

In addition to resources specified for classrooms, each building will be supplied with additional equipment to be used as shared resources. These resources will include CD-ROM towers, printers, a scanner, fax equipment, portable video conferencing, digital cameras, and projection devices.



## Library Automation

**Information at Our Fingertips**

The library automation initiative is intended to turn the district's library system into an "electronic doorway." The technology plan provides user-friendly, multi-platform (Windows, Mac and DOS), on-line access to the electronic card catalog at each school and the Oswego Public Library. These catalogs contain information about all books, audio, visual and other instructional resources available within each building. Follett Software's Search Plus and Union Catalog Plus products allow users to search these databases by title, author, call number, LCCN/ISBN, series and subject. There is also keyword searching in title, author, note and subject fields. Boolean (and, or, not) terms are also supported. The catalog module allows for quick production of bibliographies with full or brief entries.

CD-ROM Technology has clearly been one of the big factors leading to massive and efficient information access in the 1990's. One CD-ROM can store more than 2 years of full-text articles from *The New York Times, USA TODAY*, or *The Wall Street Journal*. To leverage this power, the technology plan provides a Meridian CD-ROM tower at each of the seven libraries. These units will allow MULTIPLE, users SIMULTANEOUS point-and-click access to any CD-ROM application loaded in the tower. The units will house standard collections of reference resources. Among these resources is an on-line database providing access to over 800 periodicals, 140 of these offering downloadable, printable full-text files. The Meridian CD-Net software will allow the librarian to easily switch CD applications loaded in the tower without entering complicated commands.

**Wide Spread Access to Wide Spread Resources**

Users are able to access any information described above from any networked computer throughout the district. For example, from one computer, using Follett Software, if a student was working on a project about whales, he or she could do any or all of the following:

- Search keywords for all the resources in individual buildings.
- Search all the school libraries.
- Search the Oswego Public library.
- Search all of the above at the same time.
- Search 800 periodicals via CD-ROM.
- Search an electronic multimedia encyclopedia.
- Search the thousands of resources available on the Internet.

In the near future, the libraries will implement Follett's Catalog QuickLink. This will allow students, faculty, and community members to access any of the library catalogs from home. Requirements to dial-in from home will be minimal: a computer a modem and software that is available at no charge.

**Tools for the Library/Media Staff**

In order to make the library automation initiative a complete success, the plan provides tools for the media center staff that will minimize the time spent on day-to-day "clerical" activities and maximize the time spent on providing instruction and other services to the students and faculty:

*Automated Check-in and Check-out:* Follett's Circulation Plus is a complete library circulation system that utilizes barcode labels and a barcode scanner for fast Check-out and Check-in.

*Cataloging New Books and Materials:* Follett's Alliance Plus application software and specialized CD-ROM databases help build electronic MARC (Machine Readable Cataloging) databases onsite with fewer resources and minimal time investment This database contains hundreds of thqusands of book, audiovisual, serial, and juvenile records—many of which have been enhanced for the school marketplace with reading levels, interest levels and review sources.

*Taking Inventory and Doing Check-in and Check-out Outside the Building:* Follet's PHD+ (Portable Handheld Device) is a scanner designed to aid librarians in the inventory process. Scanning of barcodes or inputting of barcode information via the scanner greatly reduces the time spent inventorying collections. Additionally, the PHD+ can be used as a second computer as it is capable of handling transactions (check-in and check-out) which are then uploaded to the Circulation PlusTM system

*Collection Development:* Follett's Sneak Previews Plus is an innovative CD-ROM database designed to enhance the book preview and selection process. Sneak Previews Plus provides the librarian, faculty member or student the ability not only to read the full-text review(s) from selected journals of recently published books, but also to view a full-image cover, enhanced MARC record, text/illustration image, and if available, publisher-provided annotation, table of contents, index, author, illustrator information and interviews.

*Foreign Language Tools:* Follett's Language Pack enables the librarian to serve the needs of a bilingual patron population and also serves as a valuable learning tool to teachers in the foreign language department. When used with Catalog Plus, library services can instantly be expanded to multi-cultural patron populations and provide opportunities for practical, every day foreign language experiences.

**Services To Tie It All Together**

To ensure a smooth and effective implementation, the technology plan provides the following services purchased from The Follett Software Company.

*Training Services:* Training for library/media staff and faculty was provided by Follett Software. This training included application training as well as sessions on how to integrate use of the electronic library into curriculum.

*Data Entry Services:* (Good electronic card catalog data is critical to the success of any library automation. If materials are not cataloged correctly, completely or in a usable manner, those materials may never be utilized. Instead of taking years of valuable staff time to enter this data, the plan provides for the use of the cataloging experts at Follett.

*Implementation Services:* The district used Follett Client Services as a configuration and setup aid to the local consultants.

## Software Applications

The proposed computing environment will provide a variety of educational software tools and applications. In the 1995-96 academic year, the district will use the results of a teacher survey to plan its strategy for purchasing software that meets teachers' needs and curricular objectives. District software needs are expected to fall into four classes: student information, instructional support for staff, curriculum, and administration.

## Implementation and Support

As the phases of the plan are implemented, the district will develop a comprehensive description of the services and support requirements for the ongoing maintenance, administration, and continual updating of all software and hardware. The support plan sets parameters for security relating to data, the network, and applications and will define the role of third-party organizations including BOCES, the ELC and other contractors.

## Fulfilling the Plan: 1994-1999

### 1994-96 Accomplishments

The importance of the plan's first years cannot be overemphasized. The following three achievements, in particular, have established the foundation upon which the district will build its capability to use technology to support teaching and learning:

- Assessment of educational needs prior to the purchase of technology.
- Adoption of a network design that offers solutions for today as well as tomorrow.
- Commitment to making libraries the heart of the district's instructional resource.

Though they may seem to reflect little more than good common sense, accomplishing the first two of these tasks required breaking paradigms. First, research shows that districts often fail to involve teachers in their technology planning efforts.[4] Second, instructional technologies used in the classroom may too often be said to reflect vendor's offerings more accurately than classroom needs.

### Assessment of educational needs

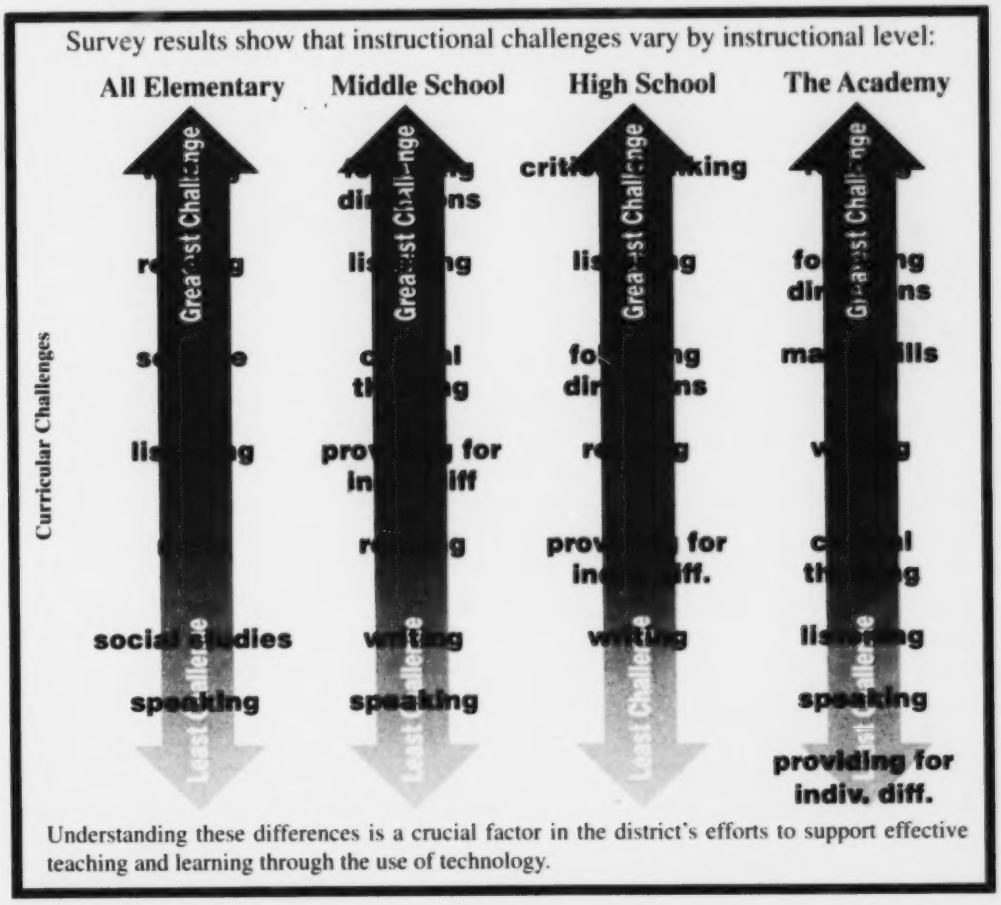
Research indicates that dramatic improvements in the student/computer ratio in American schools from 1988 to 1995 do not reflect a parallel increase in the use of these tools (US Congress, Office of Technology Assessment, 1995). There are certainly many reasons why the increasingly available technologies are not more fully tapped for their instructional value; however, teachers' lack of participation in technology planning and purchasing decisions may inhibit the integration of instructional support technologies in classrooms. Hoping to ensure that students and teachers received the greatest possible benefit from the district's technology initiative, district leaders decided to give teachers greater ownership in the decision-making process and to use classroom-based data as the driving force behind technology decisions. In the first year of the plan, all teachers from each of the district's eight campuses participated in two rounds of discussion. These discussion groups identified areas of concern and developed a list of issues to be included in a district-wide survey. Response to the survey was high (88 percent of all teachers) and the data collected set the stage for the future by . . .

[4] Philip Doughty, Donald Leu, Charles Spuches, and Barbara Yonai. "Developing Classroom-bases Data for Technology Decisions: Assisting the Implementation of Oswego's Vision for the Use of Technology - Elementary School Report," October 5, 1995. p. 14.

- providing guidance about what to purchase,
- identifying training and support needs, and
- facilitating planning related to the use of new technologies.

Based on the input received from classroom teachers, a team of independent researchers made general recommendations common to all levels of the district as well as recommendations specific to the needs of teachers in the elementary, middle, high, and alternative schools. District-wide recommendations include the following:[5]

1. Technology acquisition and training should support teachers' concerns about being able to individualize instruction to meet students' unique learning needs, especially in math, reading, science, and writing.
2. Computer technology should be extensively upgraded in classrooms if the district hopes to maximize the instructional impact of its technology plan.
3. Equipment acquisition, training, and support should include a focus on telecommunication technologies, especially if hardware and network systems permit these to be incorporated into classroom instruction.
4. The district should assist teachers to develop competency in the use of newly acquired technologies.
5. As the technology plan is implemented, extensive, systematic instructional support must be provided to assist teachers on an on-going basis.




[5] Philip Doughty, Donald Leu, Charles Spuches, and Barbara Yonai. "Developing Classroom-bases Data for Technology Decisions: Assisting the Implementation of Oswego's Vision for the Use of Technology - District Report," p. 15.



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**Adoption of a network design**

As the FDDI WAN connections are made, all members of the school community will enjoy improved access to district resources beyond those housed in their own building as well as to other public sources of information. Typically, schools' technology purchases are determined by what is available on the market, a situation that restricts curricular flexibility and requires adherence to vendors' views of what schools need. However, the district determined that, to be successful, technology investments had to be learner-driven and directly linked to teachers' expressed needs for support in meeting instructional challenges.

**Commitment to making libraries the heart of the district's instructional resource**

In the belief that libraries are the heart of the district's instructional resource, the district made upgrading the technological capacity of libraries and their staff the highest priority. Thus, the district's libraries are changing rapidly into "electronic doorway" facilities that offer students the opportunity to develop fluency with technologies that they will use in their daily lives as well as access to a vast range of content resources of the highest quality.

In this first year of the technology plan, each elementary school library offers 15 multimedia workstations equipped with CD-ROM readers; the middle and high school libraries each hold 25 such workstations. Students use these workstations to access the library system's catalogs, to determine whether or not a particular resource (print or other media) is available, and to retrieve, download, and, when desirable, print full-text periodical articles. A variety of multimedia CD-ROM titles are available to support learning. Students will be able to access their school's library catalog from any networked computer in their school building.

## Long-Term Considerations: 1997-1999

As with all technology transition plans, developments in the course of the identified project activity influences other aspects of the transition. Of particular importance to the long-range plan is support activity related to optimizing the network performance and the selection of instructional applications. The design allows for the migration and upgrade to bandwidth-on-demand ATM based applications. The district will participate in an advanced ATM based NYNET project in 1996.

Other issues include obtaining the resources and designing the schedule required to bring all the district's users into the network. This includes developing support for district-wide solutions based on client-server technology. Implementing advanced multimedia applications and video/media retrieval applications will require staff development, operational support, and training.

**Development of a Long-Term Plan for Network and Systems Support**

A long-term support plan is of critical importance to effective operations and thus to user satisfaction. District staff must be trained to manage and operate the planned network. Third-party resources, including BOCES, and ELC will provide training assistance and project management for the remaining years of the plan.

The system support plan will require review of users' expectations for service. Reviews will include the determination of the level of service required for each piece of equipment, application support, network problem identification and resolution, and ongoing installation assistance. Furthermore, identification of where the service originates will affect costs and staffing requirements. A service plan needs to be developed in conjunction with the implementation of the technology plan.

**Video**

A broadband RF coax and fiber cable system has been designed for the distribution of video-related media applications. These applications include media retrieval for VHS, interactive CD, and laser-disk platforms, cable television, broadcast programs, and internal two-way conferencing. Applications will be distributed to each classroom and office from the district media center located in the Oswego High School. The coax and fiber cable will be able to carry a maximum of 164 channels, including multimedia applications, CATV, and two-way video. Linkages will come from a variety of sources including internally developed video, local cable TV feeds, SUNYSAT, NYSERNet, and other external services. Monitors and cameras will be available on a shared basis until funding is available to install monitors in each classroom.

Video applications will originate from a single media distribution center planned to be housed in the high school; this center will complement the district's television production facility. Applications will be delivered over the fiber-optic network.

Each building will have the ability to generate local and district-wide programming from every coax location. This ability will help groups with common interests and needs to share resources. Also included will be conferencing capability to provide an effective way of disseminating information, sharing ideas, and streamlining scheduling time. The network design provides equity of access to educational technology as required by the Board of Education's vision statement.

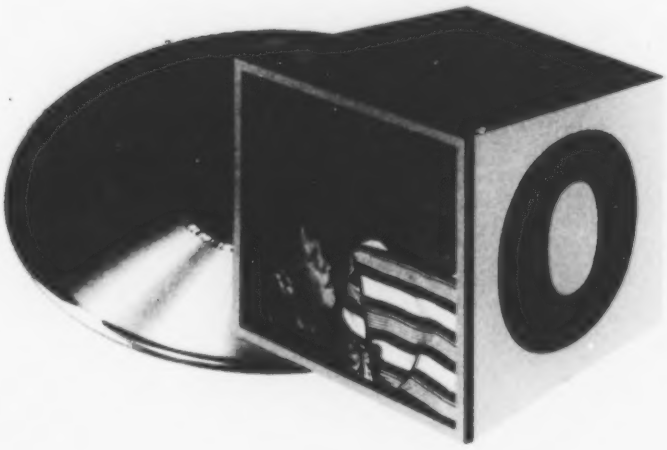
**Staff Development**

Staff development will meet participants' "readiness" level. During the months following the installation of the network, district staff members will work to identify their own needs, as well as the interests and characteristics of those involved with the use of technology. The district will work closely with Oswego County BOCES, NYSERNet, the Regional Information Center and software partners to develop an effective in-service program for teachers.

Probable content for the staff development programs will include computer basics, content area software, tool software, multimedia applications, management applications, telecommunications (including Internet access), and performance-based assessment systems.

## Conclusion

The Oswego City School District has embraced an ambitious set of objectives designed to ensure that graduates possess the world-class information-management skills they'll need in the workplace and in higher education. Through citizen and teacher involvement in the process of deciding how to best use electronic technologies to support teaching and learning, the district is building a future for the children and community it serves.



# Glossary

**10baseT:** Standard 10MB Eithernet over copper.

**10baseF:** 10MB Eithernet over fiber.

**100baseTX:** 100MB Eithernet over copper.

**ASCD**: Assiciation for Supervision and Curriculum Development.

**ASYNCHRONOUS**: A data exchange format in which the transmitter and receiver are not synchronized prior to data transmission. The time between characters is variable and is often known as start-stop transmission.

**ATM**: Asynchronous Transport Mode. The term used by ANSI and CCITT to classify cell relay technology within the realm of broadband wide area networks, specifically broadband ISDN (BISDN).

**BANDWIDTH**: Capacity of a network to move defined packets of information

**BOCES**: Boared of Cooperative Educational Services.

**BIT**: An abbreviation of binary digit. The basic unit of digital information transfer.

**BRIDGE**: A networking device that connects LANs with compatible protocols at the data link and higher layers, and forwards packets between them. Bridges can usually be made to filter packets (that is to forward only certain traffic); local LAN traffic is kept to that LAN. In Ethernet, collisions are not passed through a bridge. Only the MAC sublayer of the OSI Data Link layer and the Physical layer differ; software protocols are identical. Bridges may be local, directly connecting two Ethernets or remote using a private-line data circuit. In OSI terminology, a bridge is a Data Link Layer intermediate system.

**B-ROUTER**: A network device that provides the functions of both a Bridge and a Router. See Bridge and Router.

**CATV:** Cable televison.

**COAX**: See Coaxial Cable.

**COAXIAL CABLE**: A type of electrical cable in which a solid singe-wire conductor is covered by insulation, which is covered by another wire- mesh conductor, which is covered by an outer plastic protective covering.

**CONCENTRATOR**: Term used to define centrally located chassis into which Supervisor, 10BASE-T, Token Ring, Bridge, FOIRL, and other Modules are installed. Concentrators come in various slot sizes.

**DOS**: Disk Operating System. A set of programs that instruct a disk-based computing system to manage resources and operate related equipment. DOS is a single task operating system.

**ELC**: Educational Learning Corporation.

**ETHERNET**: The original CSMA/CD network developed by Xerox and promoted by Digital Equipment Corp., Intel and Xerox in the 1980 "Blue Book Standard."

**ETRC:** Association for Supervision and Curriculum Development's (ASCD) Educational Technology Resource Center.

**FDDI**: Fiber Distributed Data Interface. The ANSI standardized 100 Mbps fiber-optic network configured in two counter-rotating rings. FDDI uses a token-passing protocol. FDDI can accommodate up to 500 nodes with a total fiber path length of up to 100 kilometers.

**FRAME RELAY**: A variation on the X.25 interface standard that derives its name from use of the Data Link Layer or "frame" layer (Layer 2 of the OSI model) to route, or "relay", a packet directly to its destination instead of terminating the packet at each switching node. Error correction is eliminated at the switching nodes, eliminating processing overhead and increasing speeds. Based upon the LAPD CCITT standard, Frame Relay employs variable-length packets and is applicable only to data transmission at sub-broadband (T3 or lower) rates.

**GATEWAY**: A networking device used to connect two otherwise incompatible networks together. Gateways perform a protocol conversion; that is, one protocol is terminated and the data is translated to a different protocol. An example would be Ethernet to IBM's System Network Architecture (SNA). All seven layers of the OSI model are involved, so in OSI terminology, a gateway is an Application Layer intermediate device.

**GUI**: Graphical User Interface (pronounced gooey). Computer "human interface" that is based on icons rather than text. Pioneered by Xerox, implemented first by Apple, then by Microsoft Windows, Hewlett Packard and UNIX X-Windows.

**INTERNET**: When used with a lower case "i", internet refers to a collection of networks interconnected by a set of routers, which allow them to function as a single, large virtual network. When used with a capital "I", Internet refers to the world's largest internet consisting of a national backbone and a myriad of regional and local networks connecting primarily colleges, universities, and government organizations (such as the National Science Foundation and Advanced Projects Research Agency).

**INTERNETWORKING**: A term used to generically describe the connection of LANs with bridges, routers or gateways.

**IPX**: A protocol used in Novell's NetWare network operating system.

**ISA**: Industry Standard Architecture. The 8/16- bit bus architecture originally developed by IBM and now standard in almost all PCs that use Intel's 8086 and 80X86 microprocessors. Also see EISA.

**ISDN**: Integrated Services Digital Network. A project within the CCITT to standardize the operating parameters and interfaces for a network that will accommodate a variety of mixed digital transmission services. Two access channels defined are BRI and PRI.

**LAN**: Local Area Network. Generic term for a localized PC network typically using Ethernet, token ring, Arcnet, or other protocols.

**LAN MANAGER**: The OS/2-based network operating system developed by Microsoft.

**LAN NETWORK MANAGER**: IBM's network management for personal computer based token ring networks.

**LOCALTALK**: Apple Computer's 230-Kbps baseband network used primarily with its Macintosh computers and LaserWriter printers. LocalTalk uses the CSMA/CA media access method. The older Phase 1 is limited to 254 nodes, while the current Phase II allows much larger (theoretically unlimited) networks. Also see AppleTalk.

**Mbps**: Megabit per second. One million bits per second.

**MHz**: Megahertz. One million cycles per second.

**MIB**: Management Information Base. The collection (database) of objects that are accessed by a network management protocol such as SNMP. The SMI defines the structure of the MIB.

**MODEM**: Abbreviation for MOdulator-DEModulator. A network device that converts serial digital data from a PC, terminal or other data device to a signal suitable for transmission over a telephone line (modulation) and also converts received signals to serial digital data (demodulation) for the attached device.

**MS-DOS**: Personal computer single-user operating system developed by MicroSoft. Used as basis for IBM's PC-DOS.

**MULTIPLEXER**: A networking device that provides the concurrent transmission of multiple information signals on a single data channel by apportioning the time available on the composite channel to the individual signals (time division) or by assigning specific frequencies to each information signal (frequency division).

**NETWARE**: Novell's network operating system based upon its proprietary Internetwork Packet Exchange (IPX) and Sequential Packet Exchange (SPX) protocols.

**NODE**: Any device, including workstations and servers, connected to a network. Also can refer to the point at which devices are connected to a network. Also can refer to the point at which devices are connected to a network.

**NT SERVERS:** See Windows NT.

**NYSERNet:** New York State Education Research Network that provides internet services in New York State.

**NYNET:** New York Network - high speed ATM testbed for leading edge telecommunication technology.

**NYNEX:** New York/New England Telephone Co.

**OS:** Operating system

**OS/2**: The multi-tasking operating system developed by IBM and Microsoft for use with the Intel 80X86 microprocessors. Unlike its predecessor (MS-DOS), OS/2 is a multitasking operating system. OS/2 also refers to operating software that will run on IBM's PS/2 family of computers.

**PACKET**: A collection of data bits and associated control information bits that is transmitted as a whole unit. In LAN terminology, the basic unit of information transfer.

**RF COAX:** Cable use to transmit video.

**RIC**: Regional Information Center

**RJ45**: Popular name for the 8-pin modular connector used in the 10BASE-T standard for UTP connections to workstations or smart wiring hubs. Actual connector is defined in ISO Standard 8877.

**ROUTER**: A networking device used to connect LANs by examining data addresses and choosing the most efficient path (route) to the destination. Like a bridge, a router restricts a LAN's local traffic to itself, only passing data on to the routed path when that data is specifically intended for it. In Ethernet, collisions are not passed through a router. Routers use a routing protocol to gain information about the network, and algorithms to choose the best route based on several criteria known as "routing metrics". Connected LANs must have common protocols at the OSI Network layer and above. In OSI terminology, a router is a Network Layer intermediate system.

**SNA**: Systems Network Architecture. IBM's name for its layered network architecture and protocols used to connect IBM computers and other products.

**SNMP**: Simple Network Management Protocol. The standard network management protocol defined by the IAB in RFC 1157 for TCP/IP based network management. Widely accepted as the defacto standard for LAN network management.

**SUNYSAT:** SUNY Satellite Cable Telecommunication System.

**SYNCHRONOUS**: A data exchange format in which data characters and bits are transmitted at a fixed rate with the transmitter and receiver synchronized by sharing a single clocking signal. This eliminates the need for individual start and stop bits surrounding each byte (character) and provides greater efficiency. Contrast with Asynchronous.

**Tiered Star:** Networking topology.

**T1**: A U.S. and Japanese standard for high- speed data transmission at 1.544 Mbps. Twenty- four 64 Kbps channels plus 8 Kbps of control information are provided. Also referred to as AS1.

**TCP/IP**: Transmission Control Protocol/Internet Protocol. A suite of protocols developed out of DARPA (Defense Advanced Research Project Agency) that allows sharing of information among PCs and computers in high-speed communications environments. TCP/IP corresponds layers 3, 4, and 5 of the OSI seven- layer model. The major protocols in the TCP/IP stack are IP, TCP, UDP, ICMP, Telnet, FTP and SMTP.

**TOKEN RING**: A 4/16 Mbps Local Area Network that uses a token-passing access method to allow nodes on the network to transmit data. Defined in the IEEE 802.5 specification. Designed with a ring architecture, a token (special data packet) is continuously passed from node to node. When a node has data to transmit it attaches the data to the token if the token is free (no other data attached to it). Every node on the ring sees the data, but only the addressed receiving node will accept it.

**UNIX**: Operating system originally developed by Bell Laboratories for communicating multi- user, 32-bit minicomputers.

**UTP**: Unshielded Twisted-Pair. Industry's generic term for standard telephone wiring.

**WAN**: Wide Area Network. Generic term used to describe LANs networked together over long distances.

**WINDOWS NT**: Client and server operating system.

**WYSIWYG**: What You See Is What You Get (usually pronounced wizzy-wig). Used to describe screen presentation of text and graphics that appear as they will when printed.

## Notes



19

# Teaching Tomorrow Today:

## Oswego City Schools Lead the Information Age.....

*by Dr. Kenneth W. Eastwood*
*Director of Secondary Education and*
*Instructional/Administrative Technology*

Today the world travels on pathways of glass fiber and pulsing lights, and the destination is Oswego. The Oswego City School District is starting a new way of teaching based on the power of a telecommunications network that connects every classroom in all of our eight schools, as well as the district offices, warehouses and transportation center. Students will be able to reach great research centers such as Cornell University and libraries across the world. They will be able to collaborate with each other, as well as with scholars outside the district, vastly improving the quality of learning.

*Oswego students Katie and Jessica visit the world's research centers from their on-line computer.*

We were looking for a solid networking solution to the present and future needs of our multi-campus system. We needed more than just Internet, we wanted our students to be able to access full-motion video. If our students are to compete with the best from other places for good colleges and well-paying jobs, they need the edge that network technology can bring. A Fiber Distributed Data Interface (FDDI) backbone is the infrastructure portion of a $10 million, five-year technology plan. This plan will bring multi-media computers, video transmission and distance learning capabilities into every classroom.

We also have plans to use the school network as the platform for a community- wide network that will serve businesses, hospitals and libraries. Every facet of the community participated in the planning of the network. Salim Hariri, Associate Professor of Electrical and Computer Engineering at Syracuse University, has said, "Too many school districts are settling for networking solutions that meet current needs but that won't allow them to grow as more sophisticated multimedia systems become necessary. The FDDI backbone designed by NYNEX for Oswego is the most stable, high-speed networking technology available and will meet the district's anticipated needs over the next ten years, at least."

Students need to be able to search the resources available through the Internet and other educational networks, and understand how to work personal computers. And communities need new workers who can bring the benefits of the information age to local businesses and the local economy. In Oswego, we are building a future for our children and our community. Anyone interested in learning more about what we're doing in Oswego can contact me at the Oswego City School District, 120 East First Street, Oswego, NY 13126, or on email at **kweastwood@aol.com.**

Reprint from **NYNEX Tele*forum*** newsletter, October 1995

***Archimedes, whose experiments with geometry had convinced him that a simple tool, the lever, could do what seemed impossible, is said to have claimed, "Give me somewhere to stand, and I will move the earth." During the coming months, students, teachers, and community members in Oswego, New York, will begin to use a high-tech lever, a fiber-optic network, to, figuratively speaking, "move the world."***

## Building a community-driven technology plan

As with any quality-improvement initiative, the journey is often its own reward. While the technological infrastructure is a forward-looking response to the district's instructional needs, a decision-making process brought the community together to discuss how to best educate its young citizens. Parents, business people, community leaders, school board members, and educators worked together to define needs and find ways of giving young people a competitive advantage in a challenging social and economic environment. This community-wide involvement led to a vision statement that calls for the achievement of four key objectives:

- Construct an electronic information network
- Provide equity of opportunity for all students to learn using technology and access to network resources
- Build the ability of students and teachers to use networked resources efficiently
- Eliminate barriers to use that are associated with system maintenance and obsolescence



## Establishing the network infrastructure

The school district based its technology plan on an assumption that education will increasingly rely on accessibility of information maintained on electronic servers. "We were looking for a solid networking solution to the present and future needs of our multi-campus system," says Kenneth W. Eastwood, the district's Director of Secondary Education and Instructional/Administrative Technology. With help from Albany-based Educational Learning Corporation, the district began its search for an infrastructure that would address the following issues:

- ***Stability*** - Create the network infrastructure once. Both technological and topological changes must be achieved without disruption.
- ***Flexibility*** - Provide for expandability and scalability by selecting standards for applications, platforms, protocols, and carrier services.
- ***Manageability*** - Adhere to industry standards and maintain a commitment to technology management and network analysis.
- ***Performance*** - Plan for expected capacity and ensure adequate bandwidth for advanced communications and applications.
- ***Cost-Effectiveness*** - Make the best use of existing and new equipment where appropriate and design the network for voice, data, and video on the same infrastructure.

After researching its options, the school district decided to use a high-speed Fiber Distributed Data Interface (FDDI) as its network's "backbone." FDDI is an ANSI-approved 100 Mbps fiber-optic network that accommodates an unlimited number of devices. "Too many school districts are settling for networking solutions that meet current needs but that won't allow them to grow as more sophisticated multimedia systems become necessary. The FDDI backbone designed for the City School District of Oswego is the most stable, high-speed networking technology available and will meet the district's anticipated need for sharing multimedia information over the next five to ten years," says Syracuse University's Salim Hariri, Associate Professor, Electrical and Computer Engineering. This FDDI Network is easily upgradable to ATM when and if the need arises.

The district's eight schools, district office, transportation center, and warehouse will all be LAN interconnected through local NYNEX LAN interconnect services. As high-speed networking helps Oswego's schools to share information (including text, sound, graphics, and video images) and resources in support of teaching and learning, the community gets greater value from its educational resources. And, as students gain the skills needed to work with new technologies, they become better able to succeed in the 21st century's workplaces.

## Fulfilling the plan

In the final three years of its five-year plan, the district will focus on purchasing hardware and software, continuing teachers' professional development, and servicing equipment. The future holds the promise of improving community access to the school system's resources through dial-in access and of linking schools with the public library system. Additionally, Oswego is working with NYNEX to develop a community network that will share district resources and build a marriage between community organizing and modern communications technology.

The City School District of Oswego has embraced an ambitious set of objectives designed to assure parents that children will graduate with the world-class information-management skills they'll need in the workplace and in higher education. By using high-speed networking to support teaching and learning, the district is clearly building a future for the children and the community it serves.



City School District of Oswego
Office of Instructional Technology
120 East First Street
Oswego, New York 13126

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# PIONEERING A HIGH SPEED NETWORK

## City School District

This is Room C-4. Soon it will be ...

# The Multimedia Instruction Center

## A different kind of place where learners will experience a different kind of learning!

- **What is a Multimedia Instruction Center?**

  A place where a group of students interact with the rapidly expanding universe of knowledge on the Internet.

  A place where teachers and students can produce and share teaching and learning materials which incorporate more than the printed word: video, graphics, sound.

  A place where learners of all ages can interact with the world through distance conferencing via satellite uplinks and downlinks.

- **What is the purpose of the Multimedia Instruction Center?**

  To serve as a staff development center as the Oswego City School District implements its Long Range Technology Plan.

  To serve as a resource rich learning environment for students.

- **When will the Multimedia Instruction Center be complete?**

  By the end of 1995 construction will be completed. We will begin training teachers during the spring of 1996.

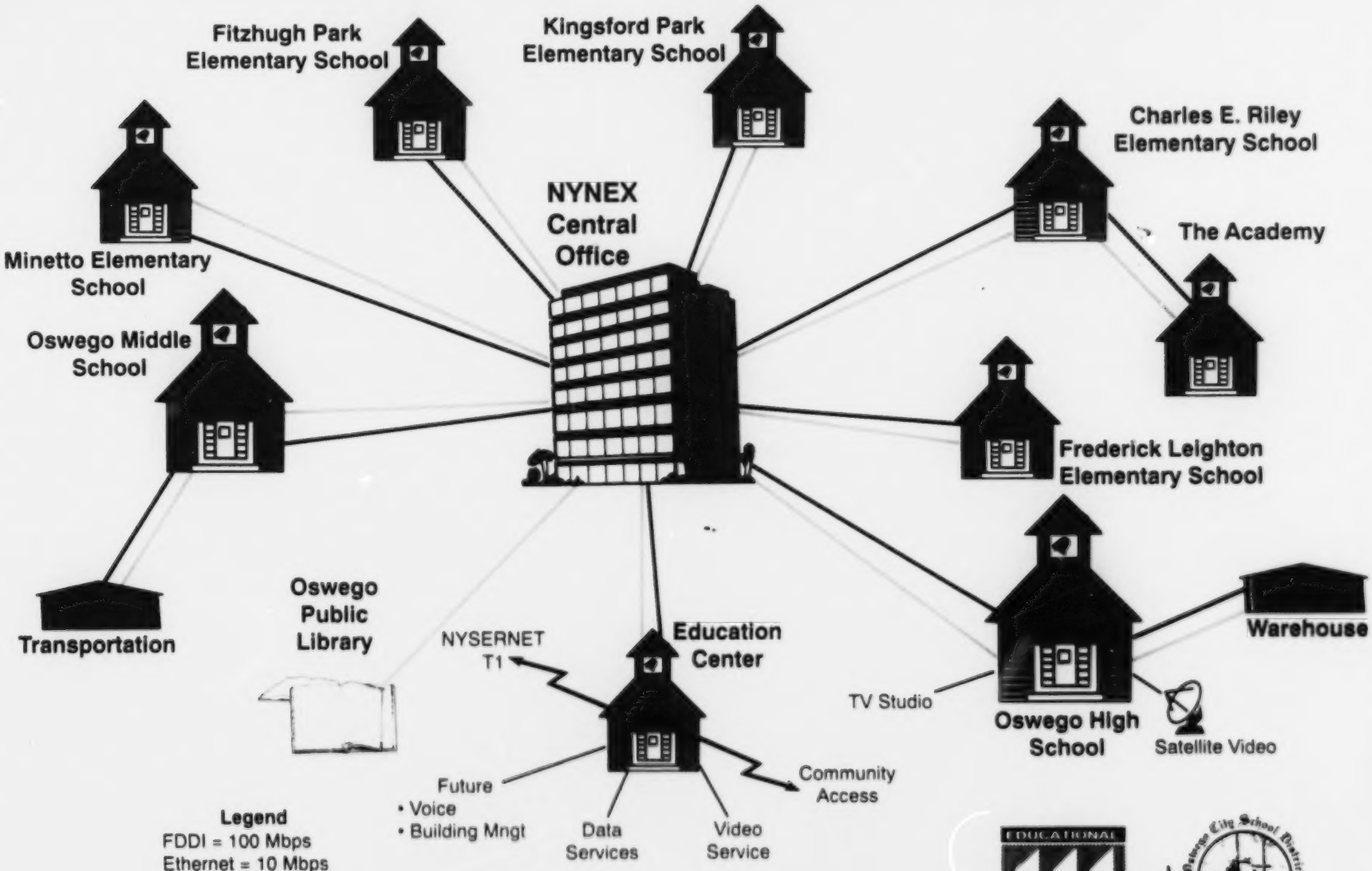
- **Why do we need a Multimedia Instruction Center?**

  Our students will benefit because research clearly shows that students learn better in a resource-rich environment.

  We can make better use of limited taxpayer resources to foster teaching and learning.

For more information about the Multimedia Instruction Center at Oswego High School call the Instructional Technology Office at 341-5801.

# Oswego City School District Data/Video Network Design

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# Oswego City School District Network Design